UNIVERSITI PUTRA MALAYSIA

ASSOCIATION OF NUTRITIONAL, FUNCTIONAL STATUS AND LIFESTYLE HABITS WITH BONE HEALTH STATUS AMONGST THE INSTITUTIONALIZED ELDERLY

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By

TEE CHIN KIM

Thesis submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirement for the Degree of Master of Science

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This thesis is dedicated to my late father, Tee Ke Hiong

Abstract of thesis presented to the senate of Universiti Putra Malaysia in fulfillment of the requirements for the degree of Master of Science

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Chairperson: **Chan Yoke Mun, PhD**

Faculty **:** **Medicine and Health Sciences**

The rising incidence of osteoporosis is well established especially among institutionalized residents. The aim of the study was to determine the association of nutritional status, functional status and lifestyle habits with bone health status among institutionalized elderly. Bone health status was assessed using Quantitative Ultrasound Sonometry (QUS-2), which measures Broadband Ultrasound Attenuation (BUA, dB/MHz) at the calcaneus. Body weight, height and body fat were assessed using SECA 767 and body fat analyzer (HBF-302 Omron). Sociodemographic background, reproductive history, history of bone fracture, lifestyle habits, dietary intake and functional status (Elderly Mobility Scale-EMS and Instrumental Activity Daily Living-IADL) of the subjects were assessed using appropriate instruments. Data were analyzed using SPSS software version 13.0 and Malaysian food composition database A total of 363 subjects comprising of 158 males (43.5%) and 205 females (56.5%) were recruited from 33 old folk's homes and nursing homes in the Klang Valley. The subjects comprised of 79.3% Chinese, 11.6% Indians, 5.5% Malays and other races (3.6%). The

mean age of the subjects was 75.8 ± 9.1 years old. The mean weight, height and body fat mass for male and female were 56.7 ± 11.9 and 50.6 ± 13.8, 161.9 ± 7.7 and 149.5 ± 11.7, 15.6 ± 7.0 and 16.7 ± 11.8, respectively. Mean Body Mass Index (BMI) for male and female were 21.6 ± 4.3kg/m^2 and 22.4 ± 5.6 kg/m^2. Based on BMI classification, 23.3% of the subjects were underweight, 52.9% with normal weight and 23.8% were overweight and obese. The mean BUA was 61.4 ± 19.8 dB/MHz. Majority of the subjects had second tertile of BUA and there was only 10.0% of subject with third tertile of BUA. The mean energy intake was 1311 ± 312 Kcal. The mean calcium intake was low, with 428 ± 277 mg in males and 454 ± 281 mg in females. More than 50% of the subjects had daily calcium intake less than RNI for Malaysian. Approximately half of the subjects achieved 75th percentile for EMS. However, score for IADL was low, with a mean of 8.6 ± 4.6. There were 61.7% of subjects who exercised currently with a majority of them practicing brisk walking. The results revealed significant correlation between BUA and weight ($r=0.390$, $p<0.01$), fat mass ($r=0.156$, $p<0.01$), phosphorus intake ($r=-0.148$, $p<0.05$), protein intake ($r=-0.121$, $p<0.05$), vitamin C (0.120, $p<0.05$), EMS ($r=0.241$, $p<0.01$) and IADL ($r=0.250$, $p<0.01$), duration exercise per session ($r=0.138$, $p<0.05$). Body weight, IADL score, and vitamin C intake were the main contributors for bone health status among the subjects, which explain 21.5% of the variation in the BUA significantly ($p<0.001$). As a conclusion, institutionalized elderly should be given better care or intervention in achieving optimal body weight and dietary intakes through providence of better nutrition and rehabilitation efforts to improve functional status.

Abstrack tesis yamg dikemukakan kepada senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Sarjana Sains

PERKAITAN DI ANTARA STATUS PEMAKANAN, STATUS KEFUNGSIAN, DAN TABIAT GAYA HIDUP DENGAN STATUS KESIHATAN TULANG DI KALANGAN INSTITUSI WARGA TUA

Oleh

Tee Chin Kim

Februari 2009

Pengerusi: **Chan Yoke Mun, PhD**

Fakulti: **Perubatan dan Sains Kesihatan**

Kenaikan insidens kerapuhan tulang adalah dikenali terutama di kalangan penduduk institusi. Tujuan kajian ini adalah untuk menentukan perkaitan di antara status pemakanan, status kefungsian dan tabiat carahidup dengan status kesihatan tulang di kalangan institusi warga tua. Status kesihatan tulang dinilaikan dengan menggunakan Broadband Ultrasound Attenuation (BUA, dB/MHz) pada kalkaneal. Berat badan, tinggi dan lemak badan dinilaikan dengan menggunakan SECA 767 dan body fat analyzer (HBF-302 Omron). Beberapa alat yang sesuai juga digunakan untuk menilai latar belakang sosiodemografi, sejarah reproduktif, sejarah kepatahan tulang, tabiat gaya hidup, pengambilan makanan dan status kefungsian (Elderly Mobility Scale-EMS and Instrumental Activity Daily Living-IADL) subjek. Data dianalisis dengan menggunakan SPSS versi 13.0 dan database komposisi makanan Malaysian. Sebanyak 363 subjek yang terdiri daripada 158 lelaki (43.5%) dan 205 perempuan (56.5%) daripada 33 rumah orang tua di Lembah Klang diambil sebagai subjek untuk kajian ini. Subjek terdiri daripada 79.3% Cina, 11.6% India, 5.5% Melayu dan 3.6% kaum-kaum lain. Min umur

subjek adalah 75.8 ± 9.1 tahun. Min berat badan, tinggi, lemak badan untuk lelaki dan perempuan masing-masing adalah 56.7 ± 11.9 kg dan 50.6 ± 13.8 kg, 161.9 ± 7.7 cm dan 149.5 ± 11.7 cm, 15.6 ± 7.0 kg dan 16.7 ± 11.8 kg. Min Indeks Jisim Badan (IJB) untuk lelaki dan perempuan masing-masing adalah 21.6 ± 4.3 kg/m^2 and 22.4 ± 5.6 kg/m^2. Berdasarkan klasifikasi IJB, 23.3% subjek adalah kurang berat badan, 52.9% mempunyai berat badan yang normal dan 23.8% adalah kelebihan berat badan dan obes. Min BUA adalah 61.4 ± 19.8 dB/MHz dan min T-score adalah -2.3 ± 2.1. Kebanyakan subjek mempunyai kesihatan tulang di tertile kedua dan hanya 10.0% subjek yang mempunyai tertile ketiga. Min tenaga makanan yang diambil 1311 ± 312 Kkal. Min pengambilan kalsium adalah rendah dengan 428 ± 277 mg di kalangan lelaki dan 454 ± 281 mg di kalangan perempuan. Terdapat lebih daripada 50.0% subjek mempunyai pengambilan kalsium harian yang kurang daripada RNI untuk Malaysia. Terdapat lebih kurang setengah subjek mencapai 75th persentil untuk EMS. Namun begitu, skor untuk IADL adalah rendah dengan min 8.6 ± 4.6. Terdapat 61.7% subjek yang berjalan sebagai senaman. Keputusan menunjukkan terdapat korelasi yang signifikan di antara BUA dan berat ($r=0.390$, $p<0.01$), lemak ($r=0.156$, $p<0.01$), pengambilan phosphorus ($r=-0.148$, $p<0.05$), pengambilan protein ($r=-0.121$, $p<0.05$), pengambilan vitamin C ($r=0.120$, $p<0.05$), EMS ($r=0.241$, $p<0.01$) dan IADL ($r=0.250$, $p<0.01$), jumlah masa bersenam per sesi ($r=0.138$, $p<0.05$). Berat badan, skor IADL, dan pengambilan vitamin C adalah penyumbang utama dalam penilaian status kesihatan tulang di kalangan subjek yang menerangkan 21.5% variasi dalam BUA secara signifikasi ($p<0.001$). Kesimpulan, penjagaan yang lebih baik atau intervensi di kalangan institusi warga tua dapat mencapai dengan berat badan dan pengambilan makanan yang optimal melalui pemberian pemakanan dan rehabilitatsi yang lebih baik untuk membaiki status kefungsian.

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The appreciation also need to award to the institutions and elderly who involved in this study. With their participation and cooperation, it had eased the data collection process. Thanks also go to friends, who had shared their unequalled expertise in statistical methods, and to those who have worked tirelessly in data collection and made my task so much easier. My appreciation also extends to the staff of the Nutrition and Dietetics Department who has supported me through my Master's studies with their tolerance. Finally but by no means less importantly, I would like to extend my thanks and love to my family who kept supporting me.

This thesis is submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of requirement for the degree of Master of Science. The members of the Supervisory Committee are as follows:

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Date: 9 July 2009

DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

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TEE CHIN KIM

Date:

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The global increases in life expectancy and sharp decline in fertility rate underlie the current, rapid aged population growth. It is estimated that the proportion of the population aged 60 or over is expected to rise from 8% in 2005 to approximately 20% by 2050 in the developing world (United Nations, 2004).

In Malaysia, elderly has been categorized as people aged 60 years and above (Department of Social Welfare, 2005). This categorization scheme is standardized in accordance to the definition stated during the "Vienna's World Assembly on Aging in 1982 (United Nations, 1997). Base1d on the Malaysian Department of Statistic (2000), it is estimated that the number of elderly with age more than 60 years old will progressively reach 3.2 million in year 2020. This phenomenon is similar with other developed countries, where there is an increment of institutions for elderly development to reside and be taken care of (Syed Abdul and Husrul, 2005).

Elderly is a vulnerable age group suffering from age-related chronic diseases, including osteoporosis (Kabir et al., 2006). There is a general agreement that there will be a significant rise of osteoporosis among the elderly in the next 20 to 30 years (Kanis et al., 2004). With the estimated rapid aging of the population, the impact of osteoporosis is expected to be prevalent among Malaysian and osteoporotic fractures will be recognized as a major public health pro1blem. According to Lee and Amir

(2007), the incidence of hip fracture in Malaysia above 50 years of age was 90 per 100,000. There was a marked increase in the incidence among the older age group and more prevalent among the women. Osteoporosis, however is highly preventable as it is developed from a long-standing lifestyle induced by multifaceted risk factors, vary depending on the racial, geographical attributes and individual characteristics (sex, age, low weight and Body Mass Index, lifestyle habits, and history of prior fracture) (Suzuki, 1998). Besides, nutrition is one of the important modifiable factors in the development and maintenance of bone mass and the prevention and treatment of osteoporosis (Hampson et al., 2003). Lau and Cooper (1996) identified that physical inactivity, a low dietary calcium intake and falls are the major risk factors for osteoporotic fractures in Asia.

1.2 Problem statement

Elderly is often accompanied with chronic illnesses and disabilities in the developing countries resulted from poverty and with little or no access to adequate health care (WHO, 2001). Chronic diseases in elderly may contribute to disability, diminished quality of life (QOL) and increased costs of basic health care and long-term care (Bean et al., 2004). The health impairment will also increase the probability of institutionalization.

Hip fractures increased exponentially with age and Projection by the World Health Organization shows that more than 50% of all hip fractures will occur in Asia with a total number of 3.2 million hip fractures per year by the year 2050 (Cooper et al., 1992). Thus, an osteoporotic fracture is not only a major problem in developed

countries but also developing countries, including Malaysia. Lee and Amir (2007) had showed an increased in the incidence of hip fractures in Malaysia as age increased. However, as not all fractures are being hospitalized, osteoporotic fracture may be under-estimated.

Institutionalized elderly are susceptible to osteoporotic fracture. Ooms et al. (1994) stated that the rate of hip fracture among institutionalized elderly is between 3 and 11 times of age matched community-dwellers. Nutritional status of institutionalized elderly is at risk of under-nutrition. Visvanathan et al. (2004) presented that the institutionalized elderly of Malaysia may be at-risk of under-nutrition and were underweight. Saudi institutionalized males living in the Riyadh also had prevalence of malnutrition ranges from 23.0-85.0% (Alhamdan, 2004).

Higher Vitamin D deficiencies were reported among institutionalized elderly as compared to community dweller (Gloth and Tobin, 1995). Vitamin D deficiency is associated with reduced calcium absorption, elevated blood concentrations of parathyroid hormone and increased bone resorption, which may lead to bone fracture eventually (Kinyamu et al., 1997). On the other hand, higher risk of osteoporotic fracture in this age group had contributed to functional decline and increased dependencies (Ang et al., 2006, Korpelainen et al., 2006, Wolinsky et al., 1997). Habitual heavy drinkers and smoking among the elderly will cause bone loss, nutritional deficiencies and low body weight (Ganry et al., 2000. Baheiraei et al., 2005). Physical inactivity is also one of the factors connected to morbidity, mortality and disables outcomes (Gerdhem et al., 2003).

Such risk factors will contribute to low bone health status among institutionalized elderly (Ang et al., 2006). The presence of morbidities are the major contributors to medical care costs in many regions of the world (Cummings and Melton, 2002; Boonen et al., 2004). In Malaysia, the medical cost for hip fractures was estimated at RM22 million (Malaysian Osteoporosis Society, 2006) and it could be underestimated as expenses of rehabilitation, medication and loss of incomes were not taken into account.

Osteoporotic fractures could cause varying degrees of morbidity and permanently disabled (Lau and Cooper, 1996; Huang et al., 2001). It is expected that the incidence of osteoporosis among elderly and its health consequences will amplify and lead to the increase of health care costs for the next few decades. Hence, the aim of this study to determine the relationship between nutritional status, functional status, lifestyle habits and bone health status can present a comprehensive picture among the institutionalized elderly.

1.3 Importance of the study

Low bone health was associated with higher mortality, debility and functional status decline among institutionalized elderly. With this, there is increased need for health and long term care services for the elderly at advanced ages. It is critical to understand the risk factors for low bone health status.

Care for institutionalized elderly in Malaysia requires the cooperation of many individuals, groups, family and friends. However, caregiver and helper in the

institutions are the primary person in taking care of the institutionalized elderly. Nonetheless not all institutionalized caregivers receive proper training. This may lead institutionalized elderly to the deprivation of appropriate dietary intake and functional disability. Education for understanding and skills development could be provided to the caregivers. With the identification of risk factors for low bone health status among this population, policy makers can plan appropriate training and course to be provided to the care givers in institutions.

As there is limited data reported among institutionalized elderly in Malaysia, identification of risk factors among these high-risk individuals will provide useful information on nutritional status, functional status, lifestyle habits and bone health status among institutionalized elderly to the policy makers and researchers. Formulation of disease management strategies from the information in this study is of major importance for maintenance of health in the institutionalized elderly.

1.4 Objective

1.4.1 General Objective

To determine the relationship between nutritional status, functional status, lifestyle habits and bone health status among institutionalized elderly.

1.4.2 Specific Objectives

1. To determine the socio demographic background (sex, ethnicity, institutions, age) among institutionalized elderly.
2. To determine the bone health status among institutionalized elderly with Quantitative Ultrasonometry (QUS-2).

3. To determine the nutritional status (dietary intake and anthropometric parameters) among institutionalized elderly.
4. To determine the functional status (mobility and dependency) among institutionalized elderly.
5. To determine the lifestyle habits (smoking, alcohol consumptions, physical activity) among institutionalized elderly.
6. To determine relationship between nutritional status, functional status and lifestyle habits with bone health status among institutionalized elderly.
7. To determine the contribution of nutritional status, functional status and lifestyle habits towards bone health status among institutionalized elderly.

1.5 Null Hypotheses

1. There is no significant relationship between nutritional status, functional status, lifestyle habits and bone health status.
2. There is no significant contribution of nutritional status, functional status, lifestyle habits towards bone health status.

1.6 Conceptual framework

The conceptual framework is shown in Figure 1.1. Bone health status among the institutionalized elderly is low and it is influence by many risk factors (Ooms et al., 1994). In this study, nutritional status, functional status, and lifestyle habits were studied to assess the association with bone health status. Nutrition is one of the

important factors in the development and maintenance of bone mass and the prevention and treatment of osteoporosis (Hampson, 2003). Dietary intakes, Body Mass Index (BMI) and body fat, milk intake, vitamin D and calcium supplementation of the subjects were assessed. Nutrients such as energy, calcium,

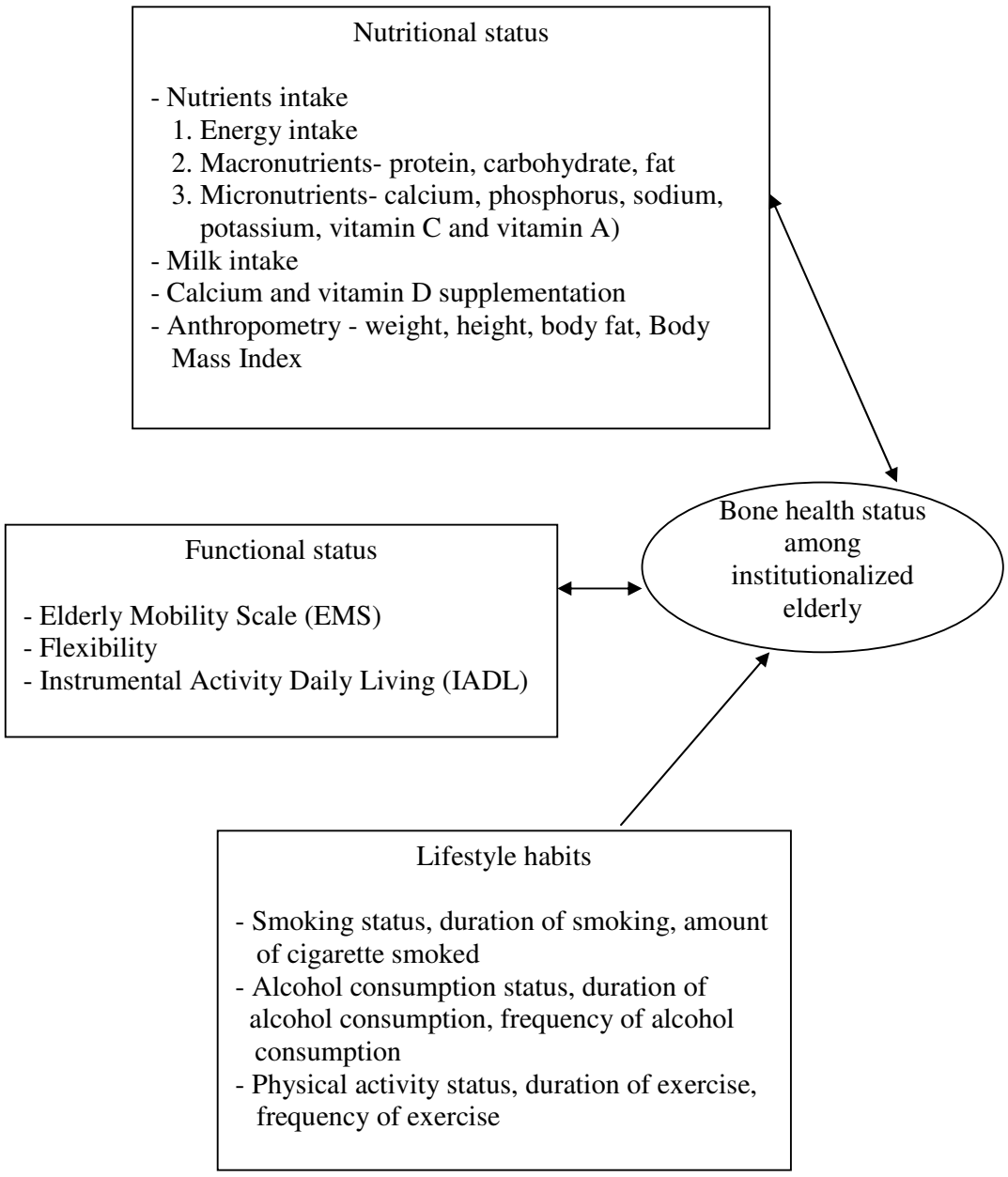

Figure 1.1 Conceptual framework

phosphorus, protein, sodium, potassium, vitamin C and vitamin A were identified as bone related nutrients. Supplementation of high calcium milk was associated with significant reduction in the rate of bone loss at postmenopausal women (Chee et al., 2003). Vitamin D intakes from food alone or from food plus supplements could significantly increase the bone health (Feskanich et al., 2003). Body weight is a determinant of low BMD. Weight loss is associated with bone loss among the elderly.

Functional status was identified as risk factor for osteoporotic fractures. Elderly Mobility Scale (EMS), Flexibility, and Instrumental Activity Daily Living (IADL) were used to assess the mobility and dependency of the institutionalized elderly. Functional disability would reduce bone mineral density and increased the risk of fractures. Lifestyle habit is one of the risk factors that may contribute to osteoporotic fractures Frost et al. (2002) and Curry et al. (2003). Smoking, excessive consumption of alcohol and physical inactivity lead low bone health among the elderly (Baheiraei et al., 2005, Ganry et al., 2000).